DNV·GL

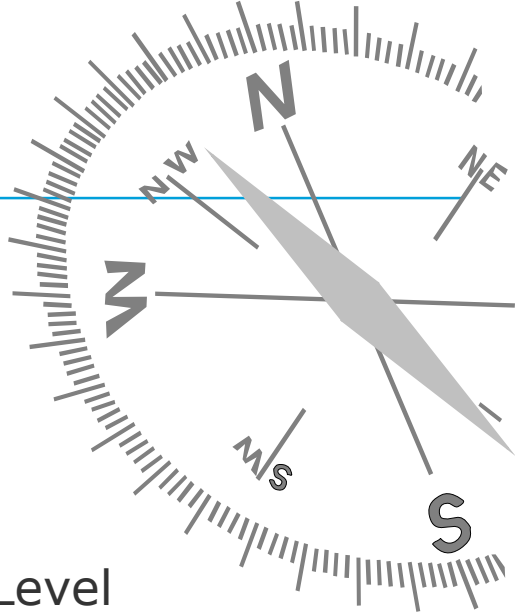
DNV GL MARITIME

Regulation of Greenhouse Gas Emissions from Maritime Transport on the International Level – what has been achieved, what remains to be done

Torsten Mundt

International Tribunal for the Law of the Sea (ITLOS), Hamburg 22 March 2014

Agenda



1. DNV·GL, a little overview post merger

2. Greenhouse Gas Emissions on the International Level from Maritime Transport
   - The CO_2 – challenge
   - IMO action on GHG
   - the new discussion: further means (**M**onitoring, **R**eporting and **V**erification)

This is DNV GL

Taking the broader view

SAFER, SMARTER, GREENER

The New DNV GL Group and ownership

DNV Foundation — 63.5%

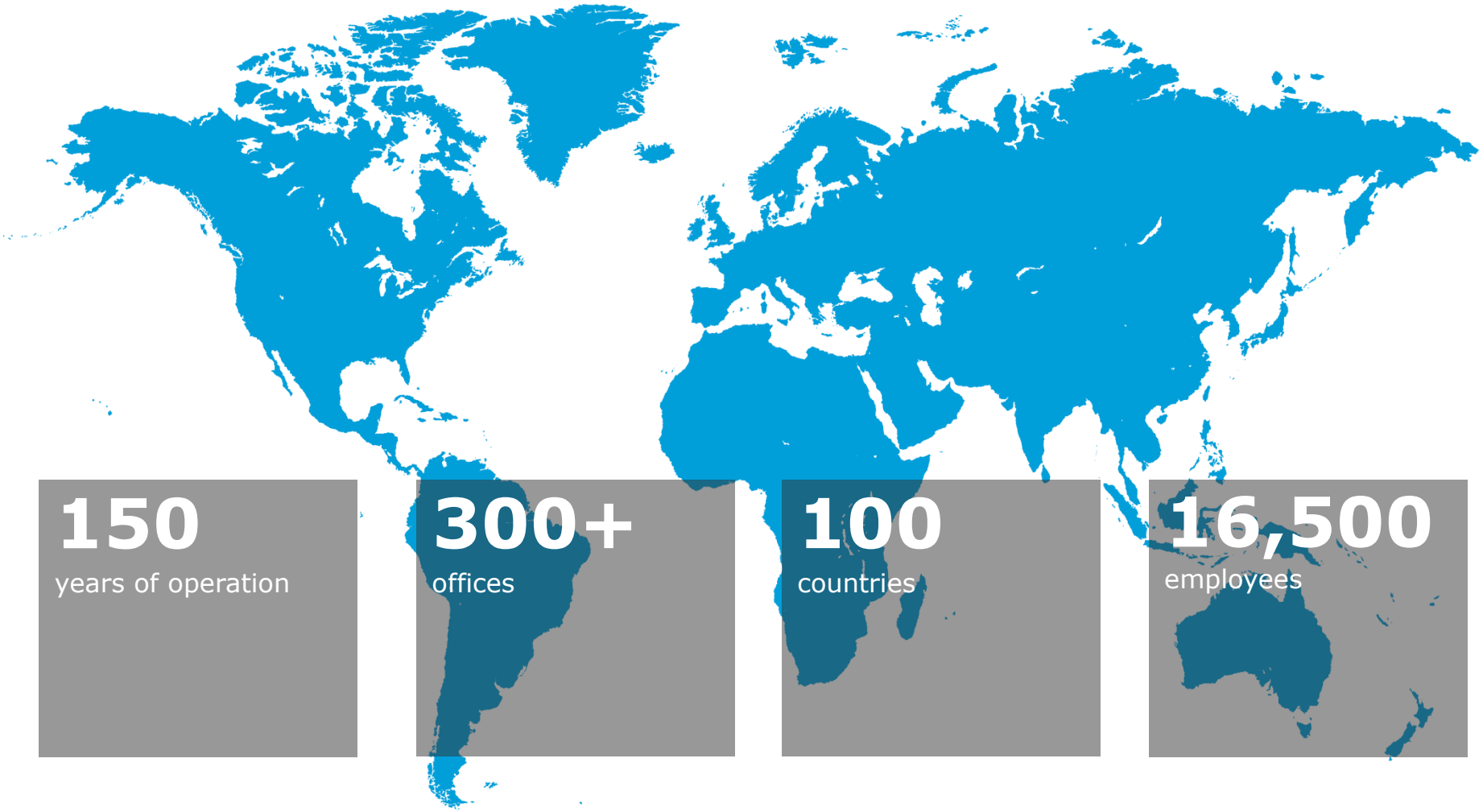
Mayfair — 36.5%

DNV GL Group
Headquarter: Oslo, Norway
Group CEO: **Henrik O. Madsen**

Executive Vice President and COO: **Remi Eriksen**

Maritime	Oil & Gas	Energy	Business Assurance
▪ Headquartered in **Hamburg, Germany**	▪ Headquartered in **Høvik, Norway**	▪ Headquartered in **Arnhem, Netherlands**	▪ Headquartered in **Milan, Italy**
▪ CEO: Tor E. Svensen/Erik van der Noordaa ▪ Number of employees: approx. 5,600 ▪ Representation in over 80 countries	▪ CEO: Pekka Paasivaara ▪ Number of employees: approx. 5,800 ▪ Representation in over 30 countries	▪ CEO: David Walker ▪ Number of employees: approx. 3,100 ▪ Representation in over 30 countries	▪ CEO: Luca Crisciotti ▪ Number of employees: approx. 2,000 ▪ Presence in 50 countries

Highly skilled people across the world



An innovation power house

- We invest 5% of our revenue in research & innovation
- We innovate in collaboration with customers, leading universities and external organizations
- We undertake own long-term strategic research and joint industry projects
- Through strategic research we provide foresight and initiate competence building needed for the future
- We provide a long-term view on business and industry solutions

Strategic Research Programs

OIL & GAS AND ENERGY SYSTEMS

- Offshore Safety
- Safety and Reliability of the Subsea factory
- Energy foresight
- Pre-Study on renewables

ARCTIC TECHNOLOGY

- Arctic Offshore Structures
- Arctic Ship Structures
- Arctic Oil Spill Preparedness

MARITIME TECHNOLOGY

- Safer Shipping
- Greener shipping
- Smarter Shipping

HEALTHCARE

- Patient Safety

INFORMATION TECHNOLOGY

- Autonomous Systems
- Big Data Analytics of Sensor Data

POWER SYSTEMS AND CERTIFICATION

- Super Grid
- Smart Grid
- Storage

MATERIALS

- Materials in Energy and Storage
- Risk Management of Corrodible Systems
- Advanced Materials and Sensors

CLIMATE CHANGE

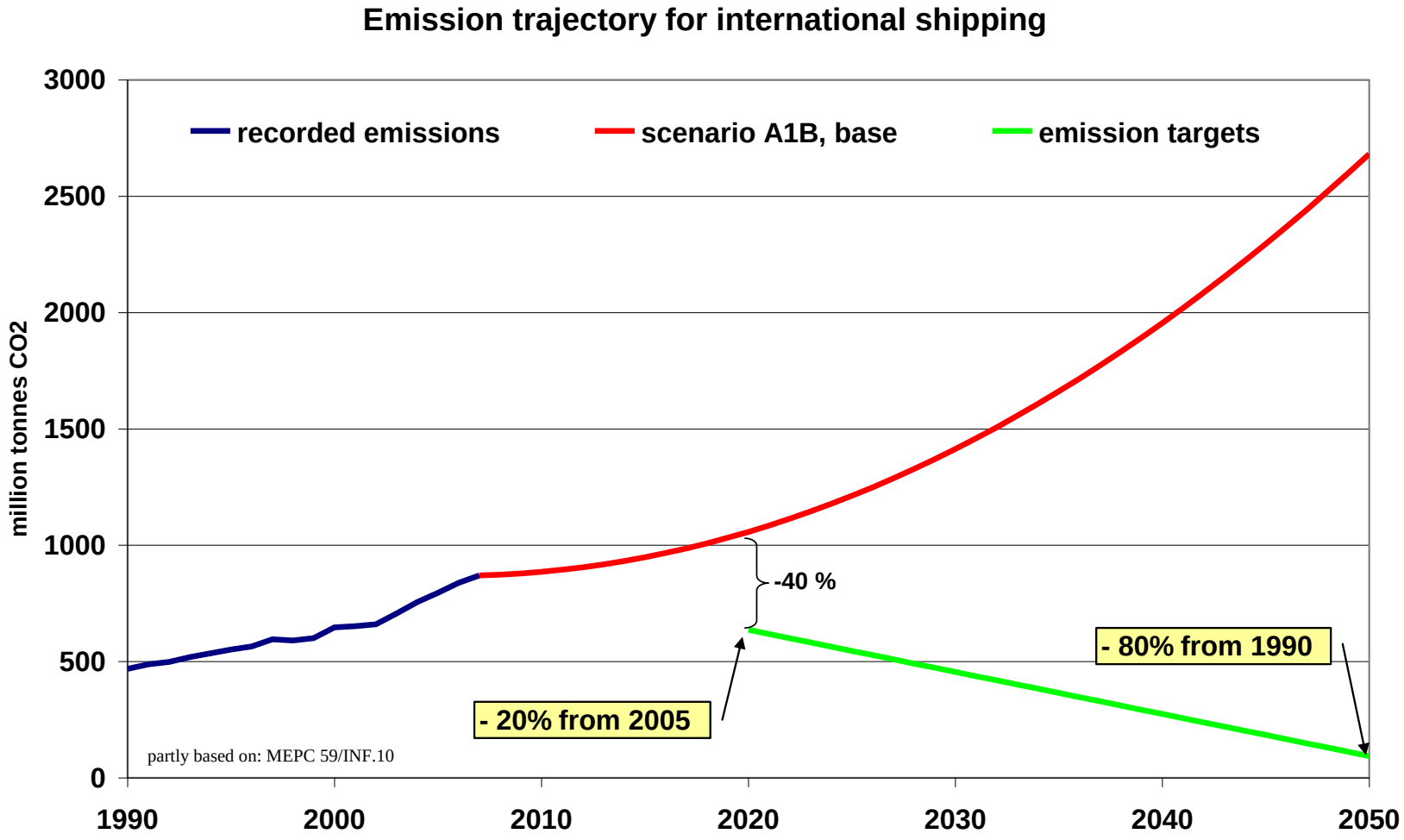
- Adaption
- Mitigation

CO_2

GHG a challenge for mankind

- To avoid the worst impacts of climate change CO_2 equivalent (CO_2e) need to be stabilised between 450 ppm and 550 ppm.
- The aim is to limit the average global warming to 2°C.
- Today's level is 400 ppm CO_2 and is rising 2 ppm each year.

The CO_2-challenge for shipping



IMO addresses GHG emissions

- The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 and entered into force in 1994. At the last count, UNFCCC has 196 members and 3 observer parties.
- The Kyoto Protocol was adopted in 1997 to supplement UNFCCC and entered into force in 2005. At the time of writing, the Protocol had 166 Parties. Annex-I-countries are required to reducing their overall greenhouse gas (GHG) emissions by an average of 5.2% below their 1990 level until 2012.
- In December 1997, UNFCCC tasked the "*Subsidiary Body for Scientific and Technological Advice*" (SBSTA) to elaborate on the inclusion of emissions from international bunker fuels in the overall inventories of Parties to the UNFCCC.
- In June 2002, SBSTA, invited IMO to report to SBSTA on its activities with regard to the reporting of emissions based upon fuel sold to ships engaged in international transport.
- **IMO Assembly resolution A.963(23) (adopted in Dec. 2003) tasked the MEPC to identify and develop the necessary mechanisms needed to achieve limitation or reduction of GHG emissions from ships.**

IMO measures to reduce GHG-emissions

- IMO Assembly Resolution A.963(23) sets the starting point for the reduction of greenhouse gas emissions from shipping.
- The following instruments have been developed:

  EEDI - Energy Efficiency Design Index

  – as a mandatory technical measure for new ships (various Guidelines)

  EEOI - Energy Efficiency Operational Indicator

  – as a voluntary technical measure for ships in service (first interim Guidelines published in 2005: MEPC/Circ.471; by revised in 2009 as MEPC.1/Circ.684)

  SEEMP - Ship Energy Efficiency Management Plan

  – as a mandatory operational measure for existing ships (first interim Guidelines published in 2009 as MEPC.1/Circ.683; revised by RESOLUTION MEPC-213(63))

Energy Efficiency Indexing – the basic Concept

$$\text{EE Index} = \frac{\text{Air pollution (emitted } CO_2\text{)}}{\text{Transport work}}$$

The Energy Efficiency Design Index – EEDI

- The EEDI compares costs and benefits to society: CO_2-emissions and transport work.
  The objective of the EEDI is to increase energy-efficiency of future generations of new vessels.

$$\textit{attained EEDI} = \frac{\textit{power * spec. fuel cons. * emission factor}}{\textit{capacity * speed}} \leq \textit{required EEDI}$$

$$\frac{\left(\prod_{j=1}^{n} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}*\right) + \left(\left(\prod_{j=1}^{n} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}**\right)}{f_i \cdot f_c \cdot Capacity \cdot f_w \cdot V_{ref}}$$

* If part of the Normal Maximum Sea Load is provided by shaft generators, SFC_{ME} and C_{FME} may – for that part of the power – be used instead of SFC_{AE} and C_{FAE}

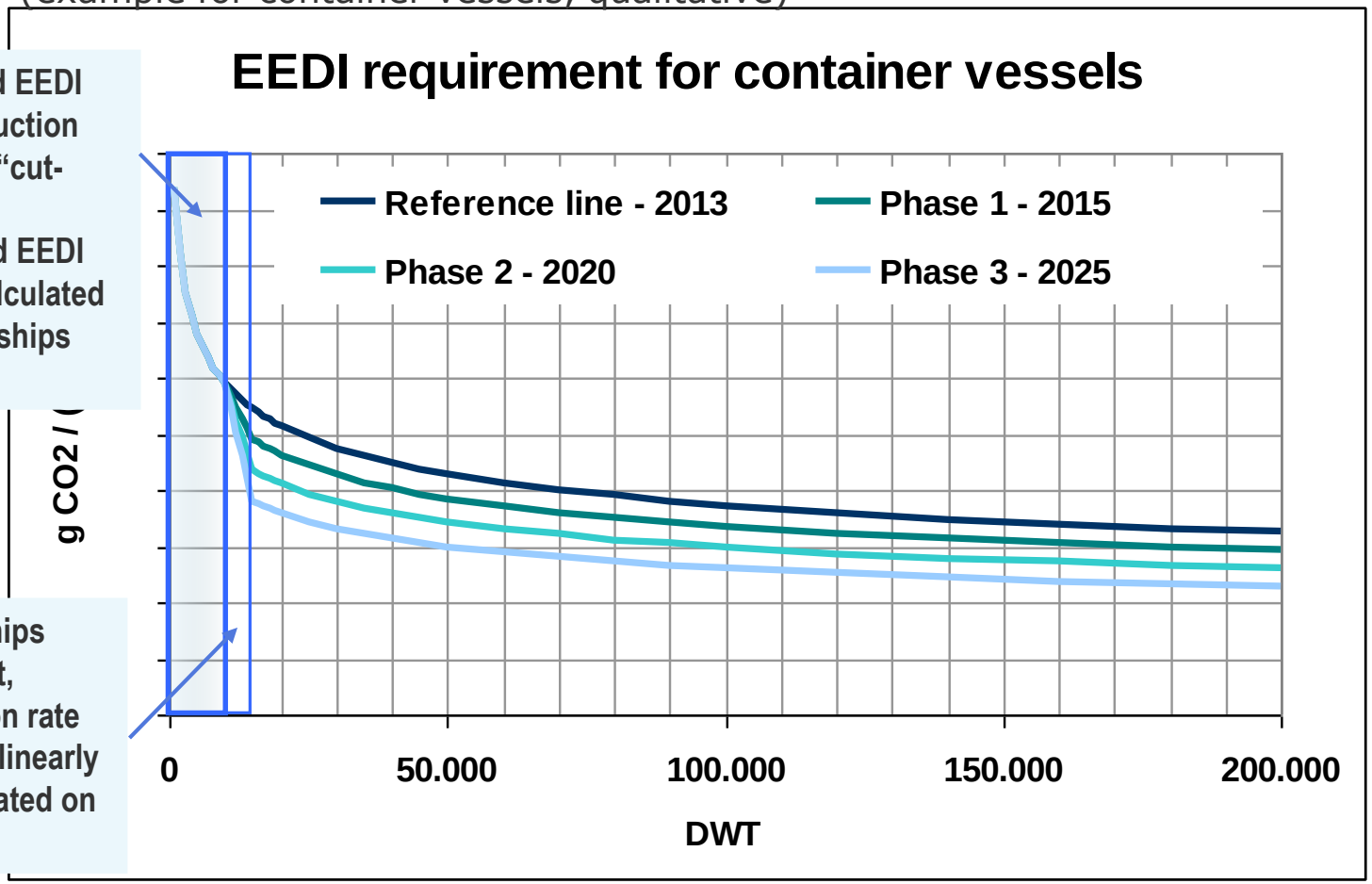
** In case of $P_{PTI(i)}>0$, the average weighted value of (SFC_{ME} ˙ C_{FME}) and (SFC_{AE} ˙ C_{FAE}) to be used for calculation of P_{eff}

Future required EEDI will be reduced stepwise

(example for container vessels, qualitative)

No required EEDI and no reduction rate below "cut-off", but attained EEDI must be calculated for all new ships > 400 GT

small ships segment, reduction rate depend linearly interpolated on dwt.



IMO Measures to reduce GHG - Emissions

IMO is committed taking the lead in developing GHG reduction strategies and mechanisms for international shipping.

This has been activated on several layers:

1. Technical measures → EEDI
   (for new ships)
2. Operational measures → SEEMP
   (ships in service) (EEOI, voluntary)
3. ~~Market based measures → various have been discussed~~
   ~~(all ships) (e.g. ETS, fund, bunker surcharge, ..)~~

"**The MBM debate is dead for the time being**"

new work Item adopted at MEPC 65:
'Further technical and operational measures
for enhancing energy efficiency of international shipping'

UNFCCC mandate

- IMO was invited to address GHG emissions in shipping sector*

- Slow progress in GHG debate at IMO is accounted to the different opinions on the working principle of IMO, called:
  "No more favourable treatment" (NMFT),
  which is in conflict to the UNFCCC principle of
  "Common but differentiated responsibilities" (CBDR).

UNFCCC – United Nations Framework Convention on Climate Change
GHG – Greenhouse gases

* Assembly Resolution A.963(23)

Further technical and operational measures at IMO

As MBM discussion stalled at IMO a group of so-called "like minded states" wants to advance the "energy efficiency" for the existing fleet...

"MRV" is the basis for all proposals,
but be aware of the data details and the outset about what is defined as the "limit" at the end (used as 'efficiency metrics') ...

US submitted a proposal for MEPC 64 (revised by MEPC 65/4/19) and added by three further proposals to MEPC 65.

Three proposals make use of a **phased approach**:

1. **Data Collection and Analysis Phase**
2. **Pilot Phase**
3. **Full Implementation**

Further technical and operational measures at IMO

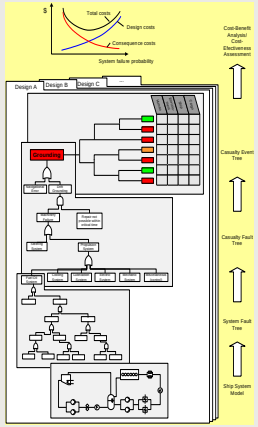
the Proposals and their "efficiency criteria":

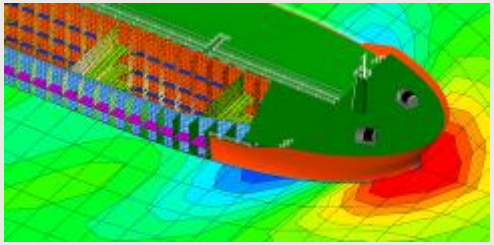
1. US: evaluation criteria by "Service hours or distance sailed"
   - no real info about how it would work under Phases II and III
2. Japan: evaluation criteria by "Annual EEOI"
   - also not foreseeable where limits could be set for phase II / III
3. EU: efficiency indicator "distance travelled"
   - limit criteria is compared to a scheme where the ship efficiency is defined once by the methodology of the EEDI-reference line calculation. The targets for an individual ship are related to their initial efficiency.
4. GER et al.: Fuel Oil Reduction Strategy, "fuel reporting"
   - limit criteria is derived from 2007 IMO GHG data for ship types / sizes and can be calculated right now
   - each ship get's a limit amount of fuel and shall reduce in intervals by x %

what remains to be done

DNV·GL activity

DNV·GL maritime R&D focus areas





- **SAFER** – reducing risk extreme loads and structural integrity risk-based regulatory framework safe operations and human element complex machinery and data systems
- **GREENER** – reducing emissions emission management energy efficiency alternative fuels hybrid ships
- **SMARTER** – reducing downtime ship and fleet management tools future inspection technologies advanced simulation tools

Long Term Commitment based on shared vision, an example

- To achieve EU 2020 targets of a smart, green and inclusive economy together with the long term vision of the EU Commission's Transport White Paper and address the industry LeaderSHIP2020 objectives, the initiative "Vessels for the Future" is currently being shaped.
  - Focus on safety and environmental aspects in ship design and operation, requiring R&D efforts characterized by a long term horizon
  - Assemble a critical mass of industry stakeholders and leadership at EU level
  - Achieve novel technologies and system solutions through ensuring industrial competitiveness in a long term perspective
- Specific objectives towards 2020 are:
  - Environment: Vessel's overall CO_2 reduction of 30%; NO_x and SO_x reduction of 80 % and underwater noise reduction of 3 dB (compared to the levels of 2013).
  - Safety: Vessel's safety improvement through implementing an innovative risk based framework and continuously applying Formal Safety Assessment.
  - integrate and demonstrate some 40 new technologies

Long Term Commitment based on shared vision

Thank you for your kind attention.

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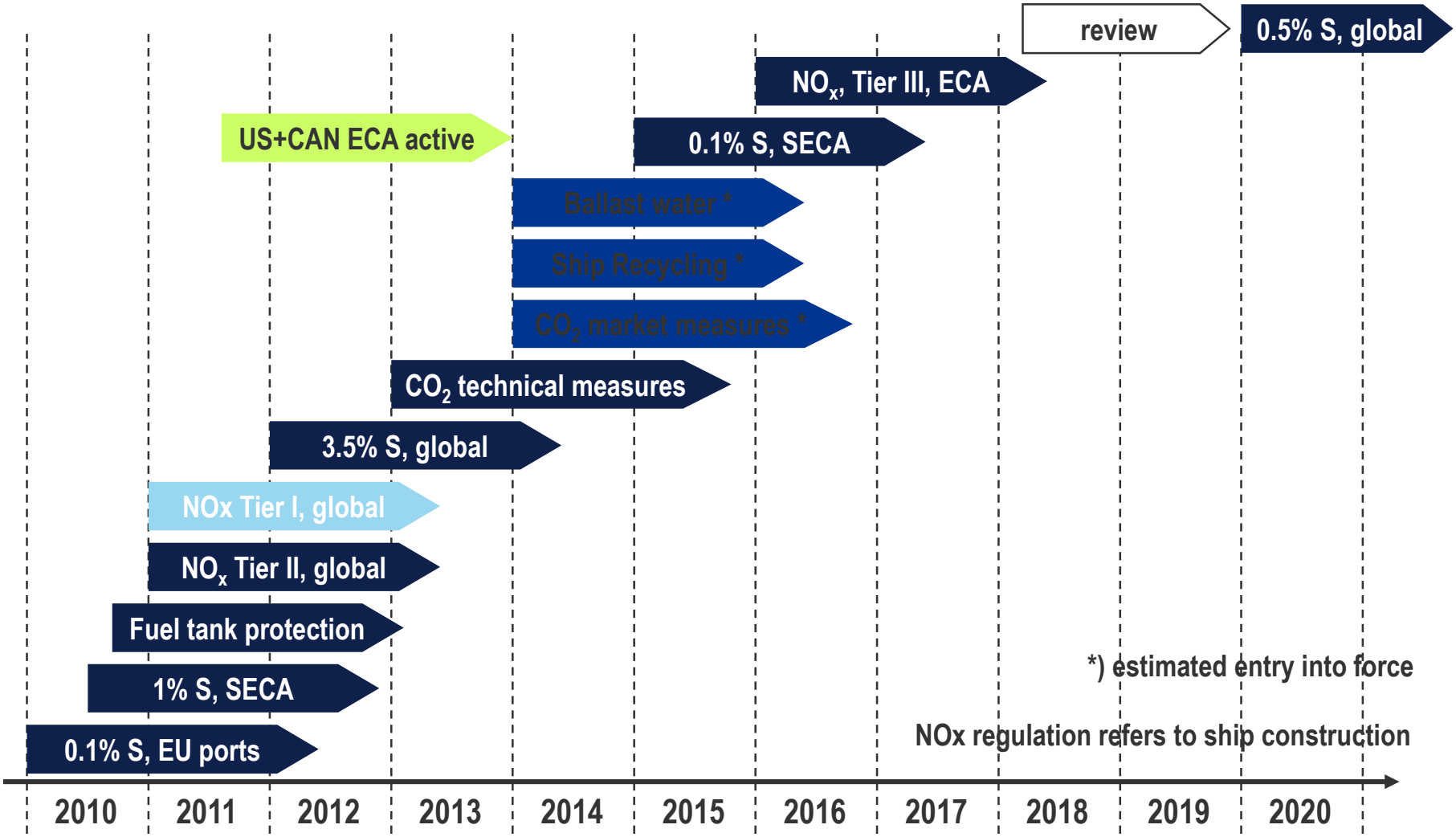
SAFER, SMARTER, GREENER

Back-up & other material

Overview and timeline for maritime environmental regulations



EEDI Calculation - formula acc. IMO (Res. MEPC.212(63))

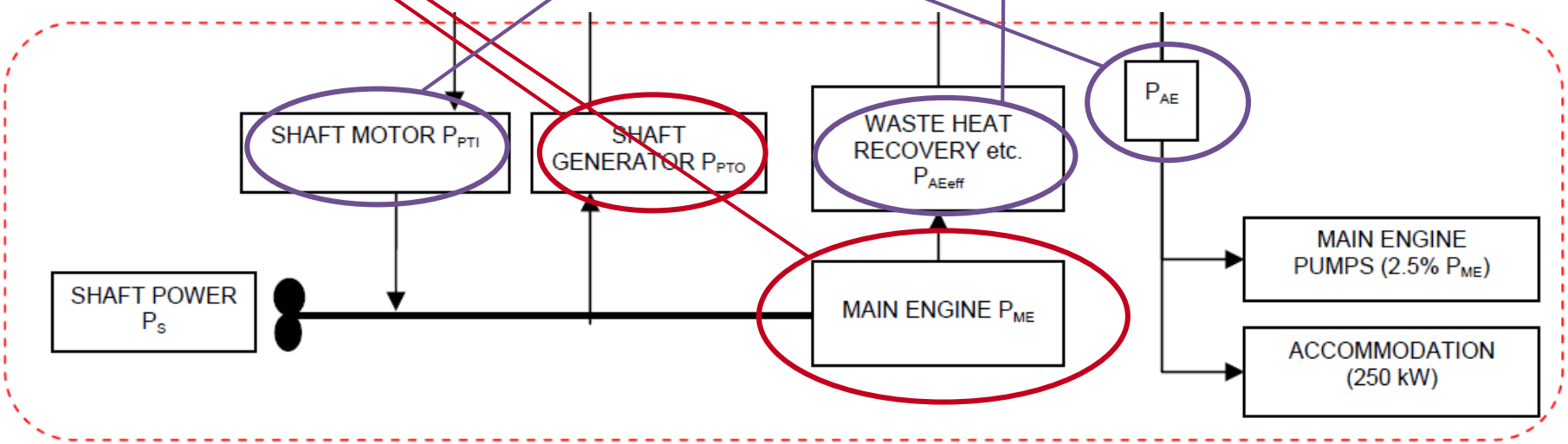
CO_2 emission main engine

CO_2 emission auxiliary engines

innovative propulsion technology (kite, etc.)

$$\frac{\left(\prod_{j=1}^{M} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE} *\right) + \left(\left(\prod_{j=1}^{M} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}\right)}{f_i \cdot Capacity \cdot V_{ref} \cdot f_w}$$

transportation work



MRV: EC-Scope

European Commission

- Ship voyages related to the EU
- Flag-neutrality
- Exclusion of small emitters below 5000 GT
- Exclusion of special ships (e.g. military, fishing)
- Focus on CO_2 as predominant greenhouse gas emission from ships
- Ship efficiency
  (expressed by different indicators) and related information
  (distance, cargo carried, time spent at sea)

The EU MRV-scheme

on "using existing documents and tools" *

1. Bunker Delivery Note

   it should be checked on how this could work in regional context

2. Tank Sounding

   the workable solution in our view

3. Flow Meters

   on some ships existing and increases the accuracy.

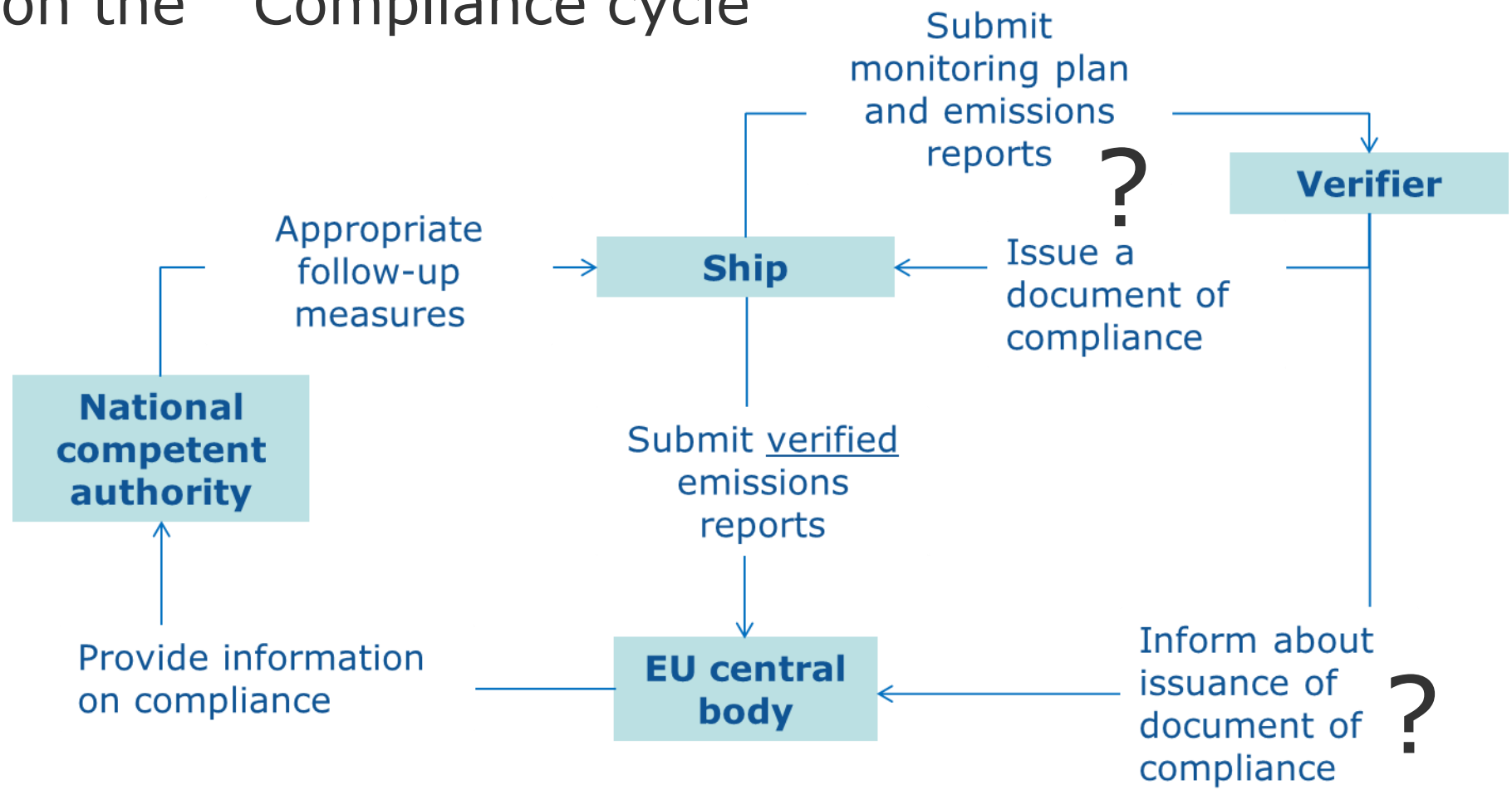
4. Emission Measurement

   A future outlook?
   Are their systems available that have proven survival in practical marine life? Claimed higher accuracy level is questions compared to Flow Meters!

* derived from MEPC 65/Inf3 - CO_2 fuel monitoring opportunities (IMarEST)

The EU MRV-scheme

on the "Compliance cycle"



on "Verification"

- Accreditation of independent verifier by national accreditation body

  Details of accreditation process are not clear
  and how about national accreditation bodies?

- Verifier's tasks:
  - Ensure the conformity of the monitoring plan with provisions of this Regulation
  - Ensure that the monitoring is done in accordance with the monitoring plan
  - Ensure that the reporting is done in accordance with provisions of this Regulation
  - Issue a document of compliance

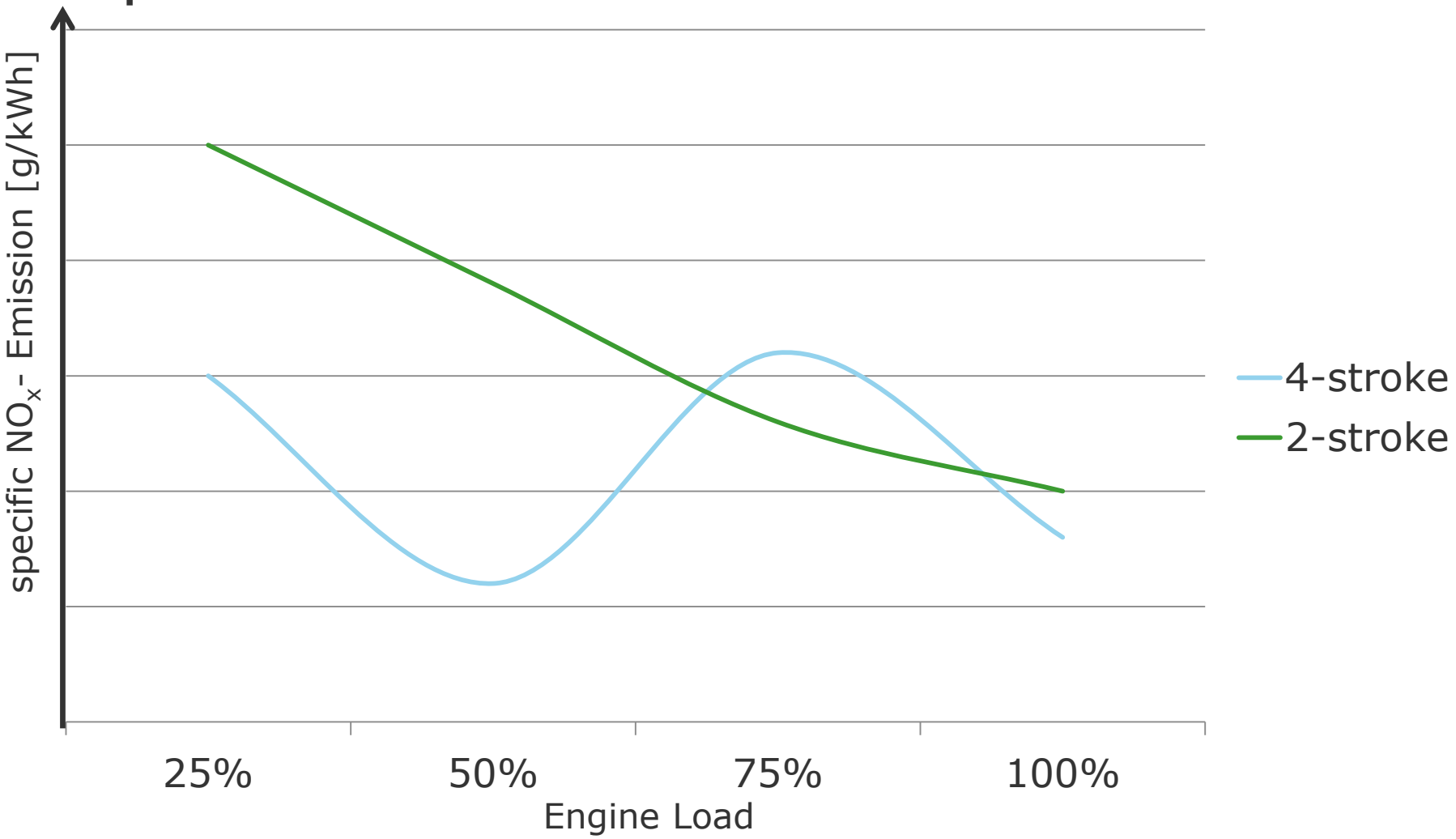
  Details of monitoring plan are not clear

  and

  who is submitting the data to the central database?

NO_x-emissions

qualitative behavior:



Conclusion

Future outlook for a sustainable "greener" shipping

- The maritime market goes „for green"
  - several shipowner designing their new buildings „greener" than required
  - Classification Societies should offer consultancy, voluntary class signs & Guidelines accordingly to ensure the required safety level of shipping
  - in this context IMO regulations will not be the only driver for new developments
- Efficient ships are the solution to minimise emission to air
  - efficient designs and operations will become of major importance
- The role of Classes
  - Class societies must provide clear Rules & Guidelines to keep shipping safe
  - Class societies should accompany this trend as an independent partner

- as explained on the MRV example, GL offers assistance:
  - with sound expert know how
  - acting as interface with technical expertise between various maritime stakeholders / politics
  - for decision making process sound knowledge basis is prerequisite

- We welcome the initiatives by BSF as:
  - we can help to stimulate knowledge based new approaches
  - communication is one of the key parameter to identify and enable sustainable shipping, as all maritime stakeholders are sitting in the same boat

Class example: a vision for sustainable shipping

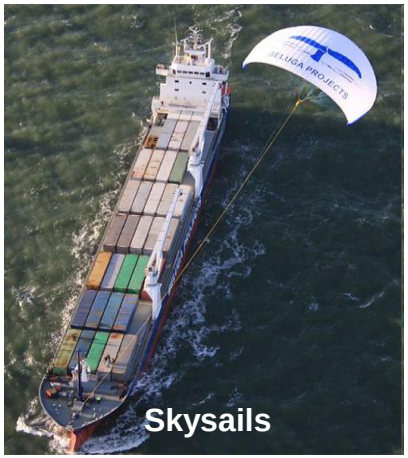
usage of wind power:

surplus of wind energy/electricity

electrolysis ► hydrogen H_2

LH_2 for short sea shipping

direct usage of wind power for shipping:



Skysails

Enercon – E-Ship 1

Conclusion

- DNV·GL is well prepared to support our customers for an up-coming MRV-scheme.
  We have extensive experience,
  dated back from 2008 with operational CO_2-Indexing.

- DNV·GL developed an own voluntary MRV-scheme with product launch at SMM 2012* called:

  "Environmental Passport – Operation"

- DNV·GL stands ready for a practical MRV-Solution and offers constructive support to stakeholders

* one month before EC announced legal MRV-plans